8

A Microscopical Inquiry *into the* Vegetable Parasites *infesting the* Human Skin. By Jabez Hogg, M.R.C.S.E., &c.

(Read Jan. 26th, 1859.)

An investigation into the many peculiarities which surround parasitic growths, and their rapid development and increase, is one that may be expected to repay the microscopist for any amount of time he may bestow upon them, and we find, indeed, as much to interest and instruct us, in this the lowest department of vegetable life, as in that of the highest. The microscope shows us that all the fungi have seed-vessels bearing fruit a hundred or a thousand fold, and that there is scarcely a spot of earth on which this fruit in the shape of minute spores cannot be found. Insoluble in nature, they wait, where they fall, the growth and decay of the particular plant for which each has its affinity; so that the enemy is near to the very soil from which it is to draw life. These spores, so imponderable, float about in the air we breathe, seeking a nidus in everything, be it vegetable or animal. In the latter, whenever the healthy processes of nutrition are impaired, and the incessant changes between the solids and the fluids slacken, the human skin then furnishes a rich and proper soil for these spores to take root in and germinate. I have lately been engaged in a microscopical examination of the products of the cutaneous surface, for the purpose of ascertaining what share the parasitic growths take in the production of certain well-known forms of skin disease, and to decide, if possible, whether they are directly and solely the cause of disease and disorganization of the epidermal structures; or whether, from a decline of the general health, or some constitutional predisposition, the parasitic vegetation is the result of disease?

For the elucidation of my subject, I have made in all upwards of eighty examinations of the products of skin diseases, taken from patients under my friend Mr. Hunt's care at the Western Dispensary for Diseases of the Skin. The products have been examined wet and dry, with reflected and transmitted light, under a power of from 200 to 400 diameters, and every means taken to avoid error. The specimens have been obtained in scaly and papulous diseases by gently removing the half-detached scales; in moist eruptions, by simply placing the discharge on a slip of glass; in diseases of the hairy scalp and beard, by uprooting the hairs and examining them immediately. The sketches were made at the same time simply with a view to a faithful portraiture of what was seen, without any reference to artificial classification on the one hand, or to pathological theory on the other; and careful drawings have been made from my sketches by Mr. Arthur Hunt to illustrate this paper. The cases examined are distributed among fourteen genera of Willan's classification of cutaneous diseases, namely, in Porrigo, Psoriasis, Pityriasis, Sycosis, Lepra, Lupus, Lichen, Impetigo, Furunculus, Eczema, Vitiligo, Spilus, Ichthyosis, and Acne. The filaments or spores of a cryptogamic plant were found in all the genera excepting Impetigo, Furunculus, Vitiligo, and Acne, and, I think, we must add Lupus, in which genera the examinations happen to have been few in number. In four distinct diseases arranged under three of these genera, viz., 1st, *Porrigo decalvans*, or *Tinea decalvans*, or *Alopecia circumscripta*; 2d, *Porrigo scutulata*, or, *Tinea tonsurans*, or, *Herpes tonsurans*; 3d, *Pityriasis versicolor*, or *P. lutea* or *Cloasma*; 4th, Sycosis or Mentagra: in these forms fungi had been seen by previous observers, as also in *Porrigo favosa*; but in the other six diseases, viz., Psoriasis, Lepra, Lichen, Eczema, Spilus, and Ichthyosis, no author had reported any observations of the kind: and so certainly have these diseases been considered free from vegetations, that they have *not* been included with the five above-named diseases, and on which the name *Dermatophyta* has been bestowed. There are probably reasons why the parasite should not so frequently be met with in these seven diseases; but I have, nevertheless, found them in the instances related, although not in all those examined, as the following record will show.

ANALYSIS OF CASES.

At the head of my list I placed *Favus*, but this disease is so rarely seen, either at the Dispensary for Diseases of the Skin, or in private practice, that I have not been fortunate enough to obtain a specimen for examination. Although so rare here, it appears to be particularly well known on the Continent, and, consequently, has received much attention. Schoenlein was the first to describe the vegetable character of the favi, and to make a drawing of the filaments and granulated stroma; this fungus is, therefore, called after its discoverer, *Achorion Schoenleinii*. Gruby described more accurately its mycelium and spores. We are told by them that Favus is frequently followed or accompanied by Pityriasis, Eczema, and Impetigo, and is therefore liable to be confounded with the fungus of *Trichophyton tonsurans*, from which it is to be distinguished by observing the difference in form and size of the spores and mycelium. The spores of the *Achorion Schoenleinii* are oval and comparatively large, whilst those of *Trichophyton tonsurans* are spherical and small. M. Gruby gives the following directions for making examinations of the products of Favus, and which answers for the examination of other skin diseases. He says, in order to examine the natural position of these fungi microscopically in the animal cutaneous structures, it is necessary to make a thin section of the capsule completely through, embracing the outward layer of epidermis, amorphous mass, and light friable matter found in the centre. It will then be found, on pressing this slightly between glasses, and examining it with a magnifying power of 300 diameters, that the cylindrical tubes (*thalli*) spring from the sides of the capsule, proceed inwards, give off branches dichotomously, which, when fully developed, contain at their terminations (*mycelia*) a greater or less number of round or oval globules (*sporidia*). These tubes are from the $\frac{1}{400}$th to $\frac{1}{500}$th of a millimetre in thickness, jointed at irregular intervals, and often contain molecules, varying from $\frac{1}{10000}$th to $\frac{1}{1000}$th of a millimetre in diameter. The longitudinal diameter of the sporules is generally from $\frac{1}{300}$th to $\frac{1}{100}$th, and the transverse about the same (Gruby). The mycelia and sporules agglomerated in masses are always more abundant and highly developed in the centre of the crust. The thalli on the other hand are more numerous near the external layer.

There may frequently be seen swellings on the sides of the jointed tubes, which are apparently commencing ramifications. On examining the hairs which pass through the favus crusts, it will often be found that they present their healthy structure; at other times, however, they evidently contain long, jointed branches, similar to those in the crust, running in the long axis of the hair, which is exceedingly brittle. I have generally found these abundant in chronic cases; and on adding water, the fluid may be seen running into these tubes by imbibition. There can be very little doubt that the tubes and sporules, after a time, completely fill up the hair-follicle, and from thence enter the hair, causing atrophy of the bulb and the baldness which follows the disease.*

PORRIGO DECALVANS. Syn. *Tinea decalvans, Alopecia circumscripta.*

The fungus known by the name of *Microsporon Audouini*, is said to cause this disease, and the light-gray crusts which cover the places deprived of hair consist of the parasite mixed with a certain quantity of epithelial scales.

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* Dr. Bennett's 'Principles and Practice of Medicine,' p. 801, 2d edition.

Case 1.—The hair near the bulb. Mycelia and filaments running along its surface, as in Pl. IV, fig. 1.

Case 2.—Baldness of portions of the scalp and whiskers. Parts examined, hair-bulbs and crust from the cheek. Fungoid filaments with masses of epithelial scales; portions of hairs were covered with filaments lying on the epithelial masses.

Case 3.—Circumscribed Alopecia of the scalp. Hair with mycelia growing and protruding from the sides, the hair itself filled with a blackish-brown colouring matter.

Case 4.—Alopecia of nearly the whole scalp. The few straggling hairs which were pulled off the scalp presented no bulb, but were distorted and broken stumpily; tufts of spores were grouped on the external surface of the hair.

Case 5.—Complete Alopecia of the scalp, eyebrows, and eyelashes, except a few straggling hairs on the scalp. Bulb and hairs entirely deficient of their animal matter, the whole depolarizing light; sporules and broken filaments scattered about (fig. 2).

Case 6.—Circumscribed bald patches on occiput and behind the ears. Hair-bulb rugged, and hair uneven and devoid of central medullary matter; striæ and all marking on the surface obliterated and covered with spores and filaments.

Case 7.—Alopecia circumscripta. Bald patches on the scalp, the remaining hair growing in profusion.

First examination.—Bulb rugged and covered with a filamentous growth standing out with a dark, well-defined outline; central pulp absent, and transverse markings obliterated.

Second examination (after three months' constitutional treatment).—Appearance improved; striæ distinctly seen, and medullary matter or pulp in a great measure restored; no filaments or spores visible.

Case 8.—Alopecia circumscripta. Three bald patches; hair generally long and profuse; bulb broken and rugged; no vegetative growth visible.

Case 9.—Alopecia syphilitica. Hair with a peculiar socket-like insertion; and there is seen projecting from the root and running upwards, a casing of very transparent epithelium; this is divided into two portions a short distance from the root.

Case 10.—Mr. M—. Bald spots with gray patches. Hairs bent and deprived of their medullary matter; a sheathing of epithelium surrounds the broken hair about one fourth of its length.

Case 11.—Alopecia circumscripta. Mycelia filaments and spores projecting ruggedly from the edges of dirty brown hair; filamentous masses very fine, drying up, and spores also; a peculiar branch of mycelium, with lance-like termination, from one of the hairs.

So that in eight cases there was most decided evidence of fungoid growth, finding in them filaments and spores. In three cases, one of which was the product of syphilis, no fungoid growth was found. The hair from the margin of the bald spots was taken for examination in most instances.

PORRIGO SCUTULATA (*Trichophyton tonsurans*). Syn. *Tinea tonsurans, Herpes tonsurans,* Ringworm of the scalp.

Case 1.—Ringworm taken at school. Character: patches of the scalp covered with minute vesicles, the discharge from which had dried into thin crusts; hair on these patches thin, light, and friable, and very scanty, being broken off short, and standing out abruptly from the skin. A fine fungoid growth was visible, the mycelia and filaments branching off very beautifully; a hair was seen covered with blackish fungi; epithelial scales abundant (fig. 3).

Case 2.—Ringworm. This child was sister to the above, and her scalp presented similar appearances. Epithelium thickened and running along the hair like a pyramid; vestiges of vegetative growth.

Case 3.—Ringworm. Filaments and spores over hairs, with peculiar bulbous protuberances.

Case 4.—Ringworm. Fungi shooting from the root of the hair; epithelial scales with filaments.

Case 5.—Ringworm. A remarkable twisting and diseased condition of the hairs, with numerous ovoid spores, but no filamentous growth seen.

Case 6.—Ringworm. Hairs matted together, and projecting from them mycelia filaments, and sporules separated and distributed; a chain of sporules projecting from a hair, as seen in cases of Plica polonica given by Küchenmeister.

Case 7.—Ringworm after dropsy. Hypertrophied epithelial scales glued together; the bulbous portion of the hair is also covered with adherent scales, upon which mycelia filaments and sporules are freely distributed; chains of sporules as in former (fig. 4).

Case 8.—Ringworm. Branched fungoid filaments and a few sporules visible.

Case 9.—Ringworm. Hairs contorted or split up into fine tow-like masses, over the surfaces of which spores were freely distributed; epithelial scales detached and filled with granular matter.

In nine cases of Porrigo scutulata the hair was examined; fungoid vegetations or vestiges of them, sometimes with sporules, sometimes without, were observable in each of these cases; but in three of them they were imperfectly seen.

It may here be observed that the filaments of the *Microsporon tonsurans,* said to be the cause of this disease, are described as found in the substance of the roots of the hair, and spreading longitudinally upwards; whereas, the *Microsporon Audouini,* the supposed source of the Porrigo decalvans, forms a tube round each hair *outside* the follicles, not in the substance of the hair.

I have not been able to verify these distinctions; on the contrary, on comparing many specimens of these diseases with each other, I have always found filaments springing up from the bulb, and then growing up around or along the hair, sometimes longitudinally in bifurcating branches nearly straight, sometimes in tortuous or spiral forms, with or without spores, as the drawings here exhibited will show. In both diseases the bulbs of the hairs and the hair itself were variously decayed and deformed.

PITYRIASIS VERSICOLOR. *Cloasma, furfuraceous* Desquamation.

Case 1.—Mr. N—. Patches about the trunk of a yellowish-brown appearance, consisting of a delicate desquamation of the epidermis. Mycelia with filaments and sporules growing and detached. Epithelial scales large.

Case 2.—Microsporon furfur. As represented in drawing, mycilia, filaments with spores in groups and clustered (fig. 5).

Case 3.—Epithelial scales and filaments.

Case 4.—Microsporon furfur.

Case 5.
Case 6. } Fig. 18. Severally showing the Microsporon furfur.
Case 7.

Case 8.—Fungoid vegetation. Epithelium deficient of nucleus and pale in colour.

Case 9.—Filaments branching above the masses of scaly epithelium.

Case 10.—Fungi in filaments and a few spores.

Case 11.—Microsporon furfur. Mycelia with filaments and spores in groups, granular matter, and epithelium; spores covering the epithelial scales, which were shrivelled.

Case 12.
Case 13.
Case 14.
Case 15.
Case 16.
Case 17.
} Severally showing Microsporon furfur.

Seventeen cases of this disease contributed specimens for examination, in *all* of which vegetations were observed, and in several of them the fungus named Microsporon furfur, supposed to be the cause of the disease, was clearly identified. This fungus is said to have been discovered by Eichstädt in 1846, and is described as exhibiting spores piled up in groups or heaps; and, although Robin himself could not find this parasite, I acknowledge that the characteristic grouping of the spores has been distinctly marked in most of the specimens I have examined. But, although this piling up of the spores may be in some measure identified with the disease, it does not follow that the disease is caused by the fungus, which may merely find in this form of disease a suitable soil for its growth and fructification. The fungus may be destroyed by soaking the skin with a nitrous acid or mercurial lotion, but unless attention is paid to the state of the blood no lotions will cure the disease.

Microsporon mentagraphytes. *Mentagra,* 'Syn.,' *Sycosis menti,* Tubercular or pustular eruption on chin and bearded parts.

Case 1.—Hairs broken and bent, covered by epithelial scales forming protuberances in the hair; mycelia covering the surface, filaments detached and sporules distributed about. Epithelial scales large, with well-marked nuclei (fig. 6).

Case 2.—Mycelia surrounding hair-bulb, sporules scattered, ovoid, and some much elongated; root broken off and covered with mycelia and worn-out epithelial scales, small in size.

Case 3.—Mycelia with filaments and spores were found on the hair, which had a good deal of colouring matter. The enlargement of the bulb of one was remarkable, giving it the appearance represented in fig. 12.

The eruption in Sycosis is peculiar, the pustules and epithelial scales run together in irregular patches over the face and scalp. This disease is thought to be produced by the fungus *Microsporon mentagraphytes.* According to Gruby it forms a kind of sheath surrounding and protecting that part of he hair which is imbedded in the skin, and whose spores re never produced above the surface of the skin. A sanious-ooking matter is discharged from the pustules, which under the microscope consists of scrofulous pus-corpuscles and irregular blood-discs, having many more of the white blood-cells than in the blood of health. The hairs were examined in six cases of Mentagra, all were broken or bent and covered by fungoid growths. The roots of the hairs were closely invested with spores and filaments, sprouting longitudinally outwards and upwards. Both the filaments and spores are described as larger than those of the *Microsporon furfur*, and are said to form a sort of vegetable sheath to the hair below the skin only. This latter description is graphic and true; but I should hesitate to admit that the mere *size* of a vegetation can entitle it to be considered a separate species; for it may depend on the age, the growth, or on some peculiarity of the soil, just as the *Polypodium filix-mas*, or common male fern, may appear in a dry, barren soil, as a delicate plant, and yet, in a damp and shaded situation, with a congenial soil, it may assume the appearance of a gigantic shrub several feet in height. Moreover, the hair, as well as the follicles and root, was found, in several instances, with tufts of fungi growing on the surface.

PSORIASIS (*Scaly disease*).

Psoriasis and Lepra are two names for one and the same disease, the former being used by authors when the scaly patches are irregularly diffused, and the other term applied when the patches are isolated and circumscribed, with elevated edges, denoting a more active though less extensive form of disease.

Case 1.—Cobweb-like appearances of mycelia and filaments. Epithelial cells treated with Liq. Potassæ exhibit a reticulated character.

Case 8.—Psoriasis guttata. Mycelia with filaments in a fine hair-like state, separated and running wider over a mass of epithelium scales.

Case 9.—Nearly cured when examined. Mycelia filaments loose, and scattered sporules; epithelial scales with granular matter (fig. 7).

Case 10.—Scales, sporules, and a few filaments.

Case 11.—Psoriasis guttata. Mycelia filaments and numerous scattered sporangiæ.

Case 12.—Mycelia and filaments branched.

Case 13.—Epithelial scales and filaments.

Thirteen cases were examined, in seven of which filaments and spores were clearly discernible, in the others epithelial scales only were found. These filaments and sporules were in no respect distinguishable from those found in the various diseases already described, and to which they have been said to be peculiar.

LEPRA.

Case 1.—Epithelial scales, surrounded by a growth somewhat doubtful.

Case 2.—Epithelial scales only.

Case 3.—Brownish-red ovoid clusters of sporules, with a filamentous growth, jointed, and epithelial scales.

Case 4.—Ovoid spores, jointed filaments, and a beautiful mass of granular matter with numerous sporules.

Case 5.—Mycelia filaments, jointed, with sporules. Epithelial scales (fig. 8).

Case 6.—Masses of filamentous matter and detached epithelial scales.

Case 7.—Mycelia filaments and sporules, with epithelial scales.

In seven specimens examined I found mycelia filaments, and spores in five of them, and in two epithelial scales only.

These fungoid vegetations were very similar to those found in Psoriasis, no doubt identical with it.

ICHTHYOSIS.

Case 1.—The disease in this case was a congenital hypertrophy of the epidermis without any other indication of disease. The appearances presented under the microscope were large epithelial scales, massed and blended without a marked separation, *the whole* intermingled with filaments; showing that a congenital disease or malformation may, under certain conditions, prepare a soil for fungoid growth.

LICHEN.

Case 1.—Neck and scalp. Disintegrated epithelial scales, mycelia filaments and sporules, reddish-brown, covering the hair (fig. 10).

Case 2.—Scales only.

Case 3.—Epithelium in abundance, with mycelia with a few spores.

Case 4.—Filaments with spores, and epithelial scales.

So that, in three cases out of the four examined, evidences of fungoid growth were visible, similar in character to those already described, and very much resembling the fungus of *Mentagra*.

ECZEMA (Vesicular eruption).

Case 1.—Eczema leproides. Thickened and worn-out epithelial scales, matted together; likewise perfect epithelium, reddish-brown; small and very numerous fungi.

Case 2.—Eczema auriculæ. Masses of mycelia, with filaments and sporules.

Case 3.—Eczema of general surface. Cast of a fine hair, consisting of filaments, surmounted by epithelial scales (fig. 9).

Case 4.—Eczema leproides. Hypertrophied epithelial scales only; nuclei and nucleoli well marked.

Case 5.—Mycelia branching from a broken portion of hair, with sporules distributed over the same.

In four out of six cases, fungoid appearances were observable; in one of them the spores were in masses or heaps, and in another a cast of a hair was noticed, the hair having escaped, and the cast made up of a beautiful reticulation of filaments, which had previously encircled the hair, precisely after the manner of that described in Porrigo decalvans; yet there was no baldness here; in fact the arm, and not the scalp, was the seat of the disease.

Tinea tarsi frequently appears as an eruptive skin disease about the head, face, and other parts of the body. Seven cases were taken from the eyelids (two were associated with eczema of the scalp), in four of which were found mycelia, with filaments and spores of a rounded form, mixed with a few accidental fat-cells, epithelial scales, and granular matter.

In two I discovered isolated spores of the fungus, described by Ardsten as the Puccinia favi, which are almost, if not quite, identical with the spores of a fungus caught in the air.

It is a remarkable and curious circumstance to find the spores of fungi penetrating to the interior of the body, and there committing ravages which are even more destructive to organic life than when they alight on the cutaneous surfaces. It is related by Hannover, of a patient who had been a long time troubled with figures as of a string of pearls before his eye, and upon the operation of parasection being performed for the relief of distressing symptoms, a fluid escaped in which was found a branched mass of *small* *cylinders*, partly filled with globules, and partly covered with minute cylindrical processes. The fungus, which occupied the entire of the interior of the eye, was nearly colourless, and consisted of fine and coarse fibres, with clear and uniform contents. Other fibres, more numerous, were moniliform, with granular contents. There were also many free globules (sporidia), which refracted the light strongly; these bodies resembled the cells of the ferment fungus of beer, but were without nuclei. The most internal masses consisted of free sporidia, and some fibres with the appearance of rows of globules. Hannover believes that, prior to the establishment of the disease which led to the destruction of this eye, there must have been the introduction of a spore of the plants through some portion of its external coat.

Helmbrecht relates another case, of a clergyman who came under his care for an inflammation in both eyes, after the cessation of which he had a constant movement of some body in the left eye, and muscæ volitantes in the right; the latter got well, while the object in the former remained, and, after a fall from his carriage, the figure became free. Helmbrecht now made a puncture in the lower part of the junction of the cornea and sclerotic. A fluid escaped, in which was found a branched mass, consisting of confervoid cells and rows of spores.*

SPILUS.

In the two following cases the moles were not congenital, but growing larger every month.

Case 1.—Dark-brown moles about the clavicular and cervical regions, prominent, adherent, increasing. Hairs with peculiar masses of pigment surrounding the shaft of the hair in tufts, with granular matter.

Case 2.—Female child. Numerous moles on shoulders, axillæ, groins, &c.; dark coloured, prominent, rapidly growing. Very fine filaments, of a dark fungoid growth, covering the surface of masses of epithelial scales. A few spores scattered about.

IMPETIGO AND FURUNCULUS.

These diseases, as far as I have been able to examine them, exhibited nothing but scrofulous-looking pus-corpuscles, with epithelial scales, and are properly described as:—

"Pustules with an elevation of the cuticle, with an inflamed base, containing pus." They are distinguishable by being more prominent and convex, with a yellow centre, the skin being reddened all around. Pressure will cause them to discharge their contents, which appear to be degenerated or imperfect pus-corpuscles with epithelial scales.

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* Dr. Küchenmeister's 'Animal and Vegetable Parasites.' Sydenham Society, 1857. Translated by Dr. Lankester.

VITILIGO.

Epithelial masses of scales held together by a watery exudation, with a few black or brownish masses.

LUPUS. *Lupus exedens* (*Lupus with phagedænic ulceration*).

Case 1.—Altered epithelium, serum and pus-corpuscles. Fungoid growth, old, and of so dark and marked a character, as to lead to the belief that it must have been an accidental deposit of recent date.

Case 2.—Large epithelial scales, with many highly refracting irregular granules of fat.

Case 3.—First examination.—Epithelial scales; small cells; fat-globules, refracting light, principally egg-shaped; and accidental starch-grains.

Second examination.—Aggregated mass of epithelial scales, held together by some pale yellowish-brown fluid; oil-globules, slightly tinged with the yellow discharge; minute ovoid bodies; fungoid sporules.

Third examination.—Fatty matter, with a little fibro-cellular tissue.

Case 4.—Submaxillary region. Epithelial scales agglutinated together by pus- and blood-corpuscles; the pus recent, and showing the characteristic nuclei upon the addition of acetic acid. Also fat- and nest-cells.

Case 5.—Epithelium large and misshapen, apparently covered with fungoid filaments; fat-corpuscles in considerable quantities, and granular matter.

Case 6.—Epithelium ovoid and broken up; struma or scrofulous pus, with fibro-plastic tissue and large masses of fatty matter; hypertrophy of the epithelial scales.

Case 7.—Pus exuding, small fat-globules, scrofulous pus-corpuscles, and epithelial scales.

Case 8.—Fat-globules, well marked, and in large quantities; scrofulous pus-corpuscles with larger cells, having smaller enclosed; epithelium large and hypertrophied.

Lupus non exedens (Lupus without ulceration).

Case 1.—Fat-globules, irregular in form, with epithelial scales very large, and pus-corpuscles.

Case 2.—Fat-corpuscles, large, but irregular in form; granular matter with hypertrophied epithelial scales, broken and pale (greasy stain on the paper containing the specimen); probably in this case some greasy application had been used.

Case 3.—Fat-corpuscles, irregular and disorganized, large and mixed with granular matter; pus-corpuscles; epithelium broken and interwoven with fibrous tissue.

The pus-corpuscles in Lupus have essentially the scrofulous character, with a thin, whey-like fluid intermixed with granular matter; the pus is irregular in form, containing granules which are peculiar; and from the relatively large proportion of fat in every specimen examined, it appears to be associated with degeneration of the fat-vesicle; which is constantly throwing off its contents. All the surrounding structures are implicated, and share in the disintegration and destruction of tissue.

"These microscopic discoveries explain," says Küchenmeister, page 144 (Dr. Lankester's translation), "not only the pertinacity of the disease—since it is well known that the lowest plants develop themselves most intensely and rapidly in a favorable medium—but also its contagious character, which is no longer doubtful. The fungus itself is the sole cause of these changes of the hair, and of the secondary irritation and congestion of the skin, which cause exudation, an accelerated formation of the epidermis, scaling off and production of crust, because the swollen hair exerts pressure on the skin."

From the results of the examinations just given, I must submit that I have drawn conclusions the very opposite to those of Küchenmeister, and am most decidedly of opinion that the vegetation found on the skin and hair is not primarily the cause, *but rather the result of disease.*

I shall now endeavour to show on what grounds these conclusions are deducible:

1st. If there be any exceptions to the general law, that parasites select the subjects of debility and decay, such exceptions are not found among vegetations belonging to the order fungi, which invariably derive their nutriment from matter only in a state of lowered vitality, passing into decomposition, or wherein decomposition has already proceeded to some extent.

2d. That the growth of these fungi is not necessarily pathognomonic of a special disease, is obvious from the fact of their having been observed in nearly all kinds of chronic skin diseases.

3d. Competent observers have not been able to find them in the diseases they are believed to engender. Thus Malherbe, Cazenauve, and Wilson deny the existence of a vegetable fungus in Porrigo scutulata (common ringworm), although this is described and depicted under the name of Tricophyton tonsurans by trustworthy observers.

Cazenauve, Didot, and Wilson deny the existence of the Achorion Schoenleinii in Favus, or *cupped ringworm.* Wilson and Cazenauve deny the existence of the Microsporon Audouini in Porrigo decalvans. In reference to the statement of the latter observer (Cazenauve) it must be borne in mind that he candidly acknowledges his ignorance of the microscope; and not to make an unfair use of these negative arguments, I must confess that I have seldom been disappointed in finding some kind of fungoid growth in all the diseases supposed to be produced by them; nevertheless, such is the similarity of form and growth in the specimens examined, that I have failed to make out an identity between the variety of parasite and the disease whose name it bears. Thus, in a case of Porrigo in a girl of sixteen, which had existed for nine years, from neglect and dirt, I found the fungus (fig. 11) described by Robin and Küchenmeister as peculiar to Plica polonica, a disease almost unknown in this country.

In the cases related of Tinea tarsi, I found sporules of the fungus described by Ardsten as the *Puccinia favi.* Robin also found in Favus the Puccinia occurring together with the *Achorion Schoenleinii,* the latter presenting itself as a constituent of the cups or crusts, while the Puccinia occurs afterwards on the desquamation of the epidermis; and this is thought by some to warrant the opinion that the Achorion is only the spermagonial form of the *Puccinia favi.* Again, it is broadly asserted by others, that the several morbid conditions are mutually convertible; and that Lichen, Eczema, Impetigo, Psoriasis, Lepra, Mentagra, &c., are but modifications of one and the same disease, resulting from accidental conditions, and not always found perfectly distinct; nay, so often are they combined and complicated, that dermatologists have assigned special names indicative of their mixed character, such as Eczema impetiginodes, Eczema leproides, Lichen urticatus, Erythema papulatum, &c.

It may be said that most of the cases examined by Mr. Hunt and myself should be referred to the latter forms of disease, and that the finding of parasitic fungi might have been *à priori* expected; in short, ought to have been found by us: but keeping in view this contingency, Mr. Hunt carefully selected *well-marked cases only* for microscopical examination.

Lastly, as to the growth of these parasites on the *healthy skin;* most conclusive experiments have been made, which go far to prove that the skin of persons in health and vigour does not afford the required conditions for their taking root in it; that inoculation succeeds in those places only where pustules have previously formed. Remak and others tried the experiment of inoculation over and over again, but found it always failed in the healthy; yet in certain exudations or peculiar states of the constitution, or where disintegrated matters existed, and which had undergone particular chemical changes, the Achorion may be made to germinate and produce growths of these identical fungi.

Remak took the spores of fresh scabs, and found he could grow them on slices of apple. After twenty-four hours, the sporidia exhibited short, pale, homogeneous, cylindrical growths, which became larger and more transparent during the following interval. Small oval cavities were observed on the third and fourth days on the outgrowths, not separated by partition-walls, which increased in size; and on the sixth day a luxuriant growth of the Penicillum glaucum, or other species of mould, entirely covered the Favus fungus; and further observation could not be made. Perhaps their development was arrested by the decomposition of the masses of fungi, owing to the chemical alteration of the soil.

The spores of the Favus fungus germinate in solutions of sugar, but produce only thallus threads; the sporidia are formed when it is exposed to the action of the atmosphere.

The mass of scabs crumbles in distilled water without germinating. The spores do not germinate in blood serum, or the solution of the white of egg, or in animal fats; but this was speedily effected when sugar was added, or a solution poured over either of them, when mildew grew rapidly over the Achorion, just as other mould spores quickly germinate on decaying fruits, &c. These experiments closely connect and identify these fungi with the vegetable-growing species, and from which they do not appear to me to differ in their most essential characteristics.

Seeing then that the fungi are characterised throughout nature by feeding on effete or decayed matter, that the fungi supposed to be peculiar to certain diseases of the skin are also found in many other diseases of the cutaneous surface, that competent observers have not been able to find them in these peculiar diseases, that sporules and filaments described as the cause of one specific disease have been found in the products of another definite disease inferred to have a parasite of its own, differing from this and peculiar to itself, and lastly, seeing that attempts have been made in vain to implant these parasites to a healthy skin—one cannot but conclude that the whole theory is erroneous, and that parasites peculiar to and productive of special diseases *do not exist.* In this opinion we are at least confirmed by the therapeutical fact, that the alleged parasitical affections are rarely, if ever, cured by destroying the parasite; but by the due administration of alteratives and tonics, capable of correcting the blood dyscrasia, which in fact originates the disease, they most assuredly *can be cured.*

These views are countenanced by distinguished pathologists. Professor Bennett, writing of Favus, says, "I believe that the pathology of Favus is best understood by considering it essentially to be a form of abnormal nutrition, with exudation of a matter analogous to, if not identical with, that of tubercle, which constitutes a soil for the germination of cryptogamic plants, the presence of which is pathognomonic of the disease. Hence is explained the frequency of its occurrence in scrofulous persons, and among cachectic or ill-fed children; the impossibility of the disease in healthy tissues, or the necessity for there being scaly, pustular, or vesicular eruptions on the integuments previous to contagion. And in some few experiments wherein it has been said that inoculation has succeeded in healthy persons, the following explanation may be offered :—that the material in which the vegetations grow may, at the commencement, in a molecular exudation, be formed either primarily or secondarily, *i.e.* there may be want of vital power from the first, as occurs in scrofulous cases, or there may have been a production of cell-forms, such as those of pus or epidermis, which, when disintegrated, and reduced to a like molecular and granular material, secondarily constitute the necessary ground from which the parasite derives its nourishment, and in which it grows."*

Very nearly the same conclusions have been arrived at with regard to the propagation of the moulds among the vegetable tribes, which at one time it was said originated by fungi. Mr. Henfrey, writing of the development and progress of vine fungus, says "that it is the cause, and not a consequence of the *murrain*;" nevertheless, with some caution and suspicion of the truth, he adds, "there are various curious circumstances connected with it not at all understood, and it is very probable that peculiar atmospheric conditions induce predisposing states of the plants."

It scarcely admits of a doubt, that all the diseases observed of late years on plants have been caused by a peculiar atmospheric condition not yet perhaps quite understood, but which, when combined with want of vigour, or, in other words, unhealthy growth, arising from the loss of some chemical element in the soil necessary to health, has been productive of the various "*murrains*" of which we have heard so much. A fact well known to microscopists is, that, during heavy, moist, and other unpleasant atmospheric conditions, the spores of various fungi can be caught by merely exposing a slip of glass in a current of air—but when the atmosphere is fine and dry, a state usually recognised as bracing and favorable to health and life, fungi and their spores are very difficult to collect, and probably are not then floating about.

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* Bennett's 'Principles and Practice of Medicine,' p. 307.

Similar causes may, doubtless, affect the microscopic characters of the products found in skin diseases, and so similar in appearance are the fungi taken in the air to those found among plants and decaying vegetable matter, that with a power of two or three hundred diameters we detect a striking analogy between them. The *Achorion Schoenleinii* in particular, and many of the vegetable moulds, recognised under the generic terms of Penicillum and Aspergillus, very closely resemble each other, in fact are forms of the same family of fungi. The botanical characters of the Penicillum, one of the most common of the fungi, forming and spreading itself as a greenish mould on decaying vegetable substances of all kinds, may be summed up in a few words: it simply consists of a mycelium of interwoven filaments, articulated and terminating in a plume-like head of minute globular spores, yellowish or bluish in colour, according to age.

The Aspergillus of Greville differs only in some slightly peculiar form of its spores, which are ovoid, and are borne on erect filaments, terminating in irregular tufts.

If the spores of either are sown on a glass slide and kept slightly moist, they quickly germinate, and their similarity will be readily perceived.

On living plants they are more familiarly recognised by such names as *smut, brand, bunt,* &c.

Table VII represents some well-executed drawings of those referred to, also an Alga found growing in distilled water, and the most common forms of fungi met with caught in the air. Upon examination, every person must be struck with the remarkable family resemblance. Even the mushroom spores differ in size only, as a comparison must prove; all the latter figures having been drawn under magnifying power of 200 diameters.

The Muscardine is due to a species of fungus like that which infests the potato, the sporules of which are said to be reproduced in the blood of the silkworm *when it becomes acid;* while the mycelia and sporules appear on the respiratory surface. Again, the fungus of the common house-fly, named Myeophyton Cohnii, is a mould found in the viscera of this insect at the beginning of autumn, when its powers of life are at the lowest point, and the natural process of decay is commencing, or has proceeded to some extent. Indeed, *hæmatophyta* infest the fluids and organs of several classes of insects, fish, and animals, and in all it would appear that certain conditions are necessary as to development, food, temperature, and habitat, for the complete evolution of these organisms. An acid condition it is found accompanies the production and growth of most of these organism; this is the case in the oïdium of muguet: we also find that the whole tribe give out carbonic acid, absorb oxygen, and contain a considerable proportion of nitrogen, a fact which may in some measure explain the destructive ravages often committed by the moulds. Their rapidity of development and growth is seen constantly in the *yeast- plant* and *red-snow* (or gory-dew).

In conclusion, I have only to observe with regard to the universal distribution of the fungi throughout each department of nature, it appears to me that *fungi even* have a purpose to fulfil in the economy of life; and so far from being parasitic pests, as some deem them, these, the lowest and earliest forms of life in the vegetable kingdom, have been from the beginning designedly intended to be, what they certainly are, useful scavengers in creation; and thus are they inevitably growing amid disease and death, for no other purpose than that of removing all festering matters from the presence of the living, which, if allowed longer to remain, must prove alike destructive of health and life.

Here also is presented for our admiration a striking and curious example of the ever-varying phases of life, and its resurrection from the ashes of decay and death. Nothing is suffered to remain idle, useless, or uncared for, in all the wondrous changes which are ever around us, for the good of the whole, and for the purpose of maintaining this spot of earth in a state fit for all the families of God's creatures. "All things, indeed, work together for their good;" and one fact is constantly obtruding itself to our gaze—that "life is inseparably linked with change, and every arrest is temporary death, and only through incessant destruction and reconstruction can vital phenomena emerge, an ebb and flow of being."

Since the paper has been in the hands of the printer, a most interesting case has fallen under my notice; that of a boy who has long been suffering from a scaly disease affecting the whole of the cutaneous surface. In some respects it resembles *favus,* and the crusts, which fall off in immense quantities, resemble the *Anchorion Schoenleinii,* in fact are wholly composed of torulæ and epithelial scales. A small piece of crust put into sugar and water passes through the usual stages of the fermentative process, and gives off carbonic acid. Any quantity of *sweetwort* might be fermented, indeed the scales look like dried yeast; proving the analogy between this fungus and the yeast-plant.

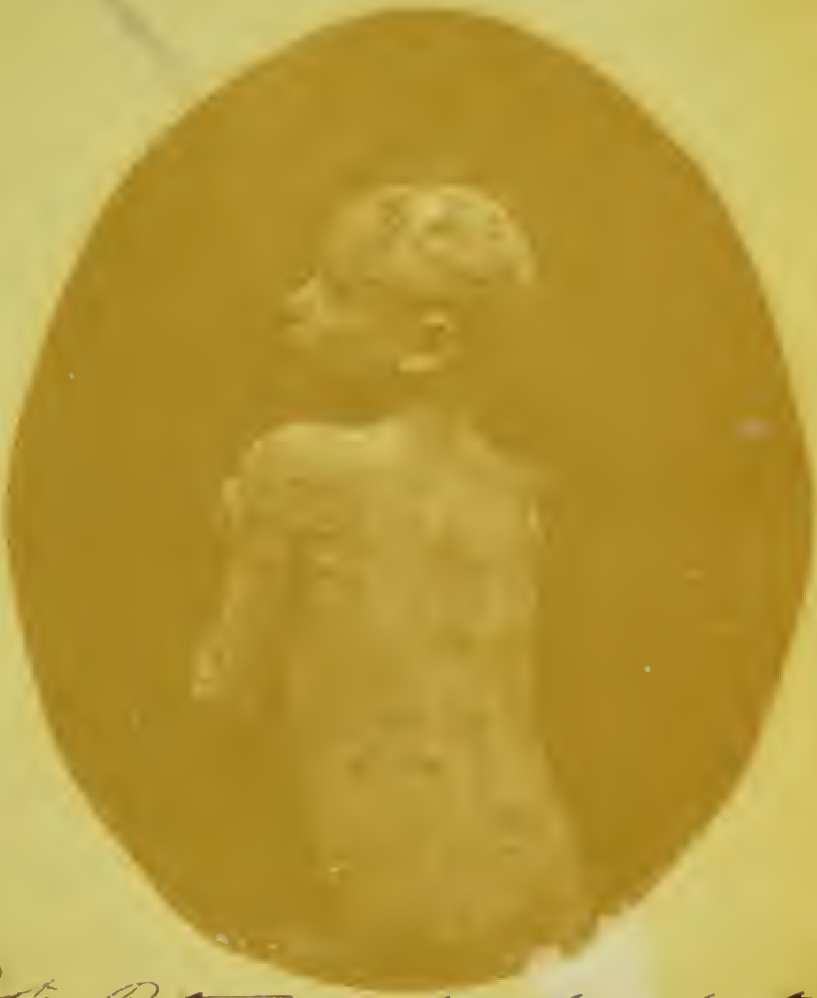


Photo. Portrait of the boy above referred to.

TRANSACTIONS OF MICROSCOPICAL SOCIETY.

DESCRIPTION OF PLATE IV,

Illustrating Mr. Jabez Hogg's paper on Parasitic Fungi in Diseases of the Skin and Hair.

Fig.

1.—Bulb of a hair from a case of *Alopecia*, with adherent mycelium.

2.—Mycelium and sporules from ditto.

3.—Mycelium in *Porrigo scutulata* (*Tinea tonsurans*).

4.—Mycelium and masses of sporules adherent to a hair-bulb from another case of the same.

5.—Mycelium and sporules from *Pityriasis versicolor*.

6.—Ditto, and portions of hairs from *Mentagra* (*Sycosis Menti*).

7.— „ from *Psoriasis*.

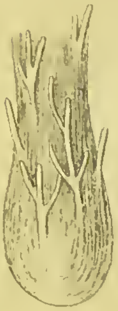
8.— „ from *Lepra*.

9.— „ forming cast of a hair from *Eczema*.

10.— „ from *Lichen*.

11.— „ from *Porrigo scutulata*.

12.— „ from *Mentagra*.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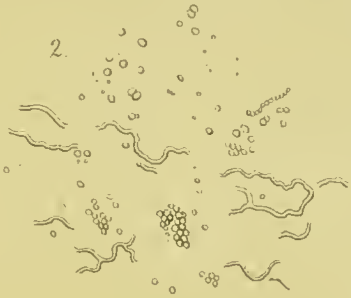
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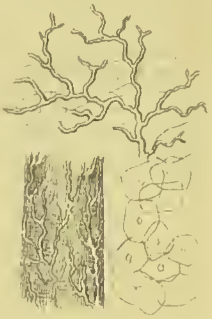
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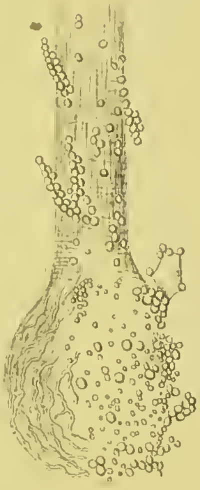
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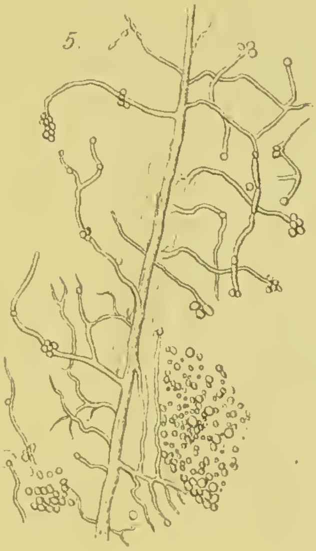
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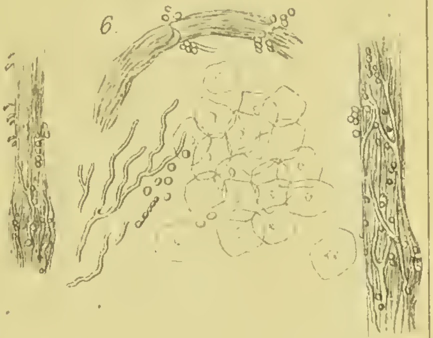
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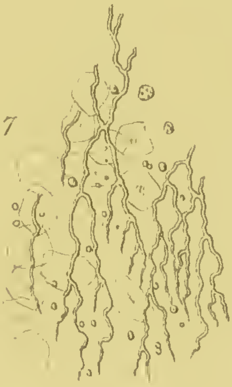
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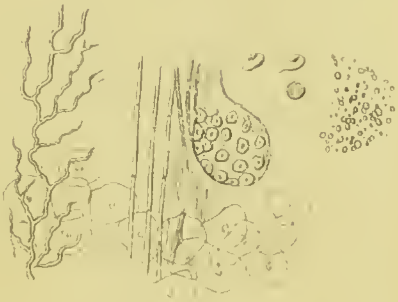
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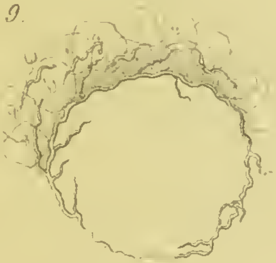
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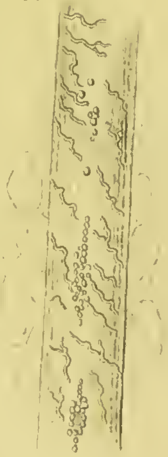
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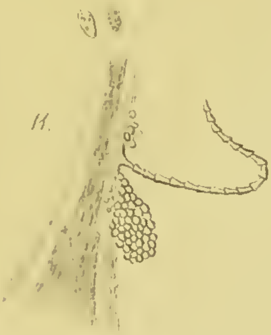
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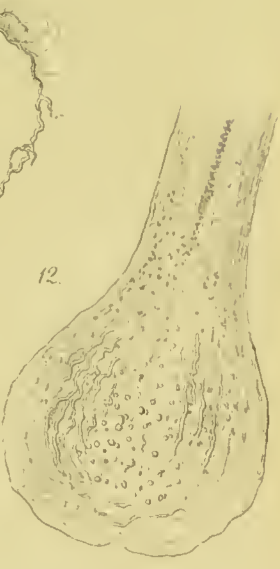
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WHITE TISSUE